CLAIMS

1. An fuel cell comprising:

a first electrode

a second electrode; and

a channel contiguous with at least a portion of the first and the second electrodes;

such that when a first liquid is contacted with the first electrode, a second liquid is contacted with the second electrode, and the first and the second liquids flow through the channel, a multistream laminar flow is established between the first and the second liquids, and a current density of at least 0.1 $mA/cm^2$ is produced.

2. The fuel cell of claim 1, further comprising:

the first liquid, wherein the first liquid comprises a fuel, and

the second liquid, wherein the second liquid comprises an oxidant.

3. The fuel cell of claim 2 wherein the channel comprises a first input adjacent to the first electrode, and a second input adjacent to the second electrode.

4. The fuel cell of claim 3 wherein the first liquid is introduced through the first input, and the second liquid is introduced through the second input.

5. The fuel cell of claim 4 wherein the first liquid is introduced through the first input using a first pump, and the second liquid is introduced through the second input using a second pump.

6. The fuel cell of claim 3 wherein the channel further comprises a first outlet adjacent to the first electrode and a second outlet adjacent to the second electrode.

7. The fuel cell of claim 2, wherein:

the first liquid comprises one or more fuels selected from the group consisting of methanol, ethanol, propanol, formaldehyde, formic acid, ferrous sulfate, ferrous chloride, and sulfur; and

the second liquid comprises one or more oxidants selected from the group consisting of oxygen, ozone, hydrogen peroxide, permanganate salts, manganese oxide, fluorine, chlorine, bromine, and iodine.

8. The fuel cell of claim 2 wherein the first liquid comprises one or more alcohol and the second liquid comprises oxygen.

9. The fuel cell of claim 8 wherein the first liquid comprises methanol or ethanol.

10. The fuel cell of claim 2 wherein the channel has a substantially straight flow channel geometry.

11. The fuel cell of claim 2 further comprising a support having a surface with first and second recessed portions, wherein the first and the second electrodes occupy the first and second recessed portions, respectively, such that an upper surface of the first electrode and an upper surface of the second electrode are planar with the surface of the support.

12. The fuel cell of claim 2 wherein the first liquid and the second liquid are immiscible.

13. The fuel cell of claim 2 wherein the first electrode and the second electrode are spray-coated on a support.

14. The fuel cell of claim 2 wherein the first electrode and the second electrode comprise platinum.

15. The fuel cell of claim 2 wherein at least one of the first electrode and the second electrode comprises ruthenium.

16. The fuel cell of claim 2 wherein the first and the second electrodes are electrically coupled.

17. The fuel cell of claim 2, further comprising a fuel sensor, wherein the first liquid comprises a fuel whose concentration is controlled by the fuel sensor.

18. The fuel cell of claim 2 wherein the second is mechanically coupled to a device selected from the group consisting of a gas exchanger, an oxidant injector, an oxidant reservoir, and combinations thereof.

19. The fuel cell of claim 2 wherein the first electrode comprises an anode and the second electrode comprises a cathode.

20. The fuel cell of claim 2 wherein the fuel cell comprises a direct methanol fuel cell.

21. A electronic device comprising the fuel cell of claim 2.

22. A portable electronic device comprising the fuel cell of claim 2.

23. A method of generating an electric current comprising operating the fuel cell of claim 2.

24. A method of generating water comprising operating the fuel cell of claim 2.

25. A method of generating electricity comprising:

flowing a first liquid and a second liquid through a channel in multistream laminar flow, wherein the first liquid is in contact with a first electrode and the second liquid is in contact with a second electrode, wherein complementary half cell reactions take place at the first and the second electrodes, respectively, wherein a current density of at least 0.1 $mA/cm^2$ is produced, and the first liquid comprises a fuel, and the second liquid comprises an oxidant.

26. A fuel cell comprising a first electrode and a second electrode, wherein ions travel from the first electrode to the second electrode without traversing a membrane, and wherein a current density of at least 0.1 $mA/cm^2$ is produced.

27. In a fuel cell comprising a first liquid containing a fuel in contact with a first electrode, a second liquid containing an oxidant in contact with a second electrode, and a membrane separating the first and the second electrodes, the improvement comprising replacing the membrane with a multistream laminar flow of the first and the second liquids.

28. A fuel cell comprising:

a support having a surface;

a first electrode connected to the surface of the support;

a second electrode connected to the surface of the support and electrically coupled to the first electrode;

a spacer connected to the surface of the support, which spacer forms a partial enclosure around at least a portion of the first and the second electrodes; and

a channel contiguous with at least a portion of the first and the second electrodes, the channel being defined by the surface of the support and the spacer;

such that when a first liquid is contacted with the first electrode, and a second liquid is contacted with the second electrode, a multistream laminar flow is established between the first and the second liquids, and a current density of at least 0.1 $mA/cm^2$ is produced.